

Origin of porphyry copper deposits: How to accumulate Cu

*Shigenori Maruyama¹, Masanori Furuno²

1. Earth-Life Science Institute, Tokyo Institute of Technology, 2. Nittetsu Mining Consultants Co., Ltd.

Study of metallogenesis has begun in 15th century and it has long research history. However, the most important process to form economic ore has not yet unraveled. The types of metallic ore varied from porphyry copper deposit to strata-bound deposit, which have been developed as economic ores in many countries of the world. The amount of copper reserves is excellent in southern coastal region of South America; particularly northern Chile (central Andes) is famous to have about 30% of world copper reserves. What do factors control such process to concentrate copper?

The primary supplier of copper is a mid-oceanic ridge where metallic elements, including copper, are fixed when chimneys are formed, which move further from mid-oceanic ridge to subduction zone through oceanic plate spreading by plate tectonics. Those metallic elements finally subduct into deep mantle at the plate convergent boundary which is a basic process to concentrate metallic elements. However, comparing to the amount of copper reserves between Japan and Chile, there is a great difference in the amount. Such a bias can be explained by (1) the location of mid-oceanic ridge, and (2) special accumulation mechanism of copper (or other metallic elements) through tectonic erosion, which is characteristic process to collect metallic elements. Accumulation of copper is driven by dehydration of subducting material both slab and eroded continental material which release metallic elements to forearc region that prohibit metallic elements being subducting into deep mantle and store within forearc region all the way since tectonic erosion started along western coast of South America. This process will be a key mechanism to unravel the Andean metallogenesis through extensive future research. To emphasize the significance of this mechanism, we name it “metallogenic copper accumulation mechanism”, and simply call it “Copper Bank”.

Keywords: porphyry copper deposit, copper accumulation mechanism, Copper Bank